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Research impact for global challenges

The current challenges facing society and science are not only immense, but global. Thus, foresight and forward-looking activities are essential when trying to take appropriate measures to meet these challenges. **Henning Klarlund** highlights the increasing importance of 'impact' to research projects.

Climate change, global pressures on natural resources, and geo-political transformations are challenging universities and researchers for responses. In *The World in 2025* – a report by the European Commission – the major future trends highlighted are: geopolitical transformations in terms of population, economic development, international trade, and poverty. The report also outlines issues relating to natural resources (food, energy, water, and minerals), migrations, and urbanisation. Among other challenges, we are faced with new transitional pathways that have been drawn towards a new production and consumption model, new rural-urban dynamics, and a new gender and intergenerational balance.

These major challenges affect us all – policy shapers, researchers, and citizens. In the knowledge-based economy, society wants research to result in beneficial and measurable impacts. This influences the universities' future research and funding strategies, as well as the future roles of research managers and administrators.

The nature of these challenges call for global collaboration. In this context, the global research community has an important role to play in finding solutions and seeing the challenges as opportunities.

Evidence-based policies

Research results contribute to a reservoir of scientific knowledge and technological options for others to fish in. Research, of course, also creates new understanding, new technological options, innovations, and expert advice. But the changing role and position of governments has resulted in a growing demand for evidence-based policies. At the same time, many countries are emphasising and investing in innovation activities that will have to be justified in terms of return of investment.

Research evaluation

Research evaluation is practised in relation to research groups, institutes, research areas, research programmes, universities, and research council systems. The evaluations are incorporated into national systems for the appropriate distribution of resources, and in the global ranking of universities.

In order to supplement and balance the traditional research quality evaluation (which focuses on discoveries, publications and patents, for example), it is important to assess the socio-economic impacts and the efficiency of public spending, and to enhance public willingness to finance research. However, socio-economic impacts cannot stand alone.

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Research impact

Identifying the nature and scope of impacts is important in order to recognise the spectrum of potential impacts of research activities. The different impacts can be diverse in scope, as well as in nature. Impacts may accrue to society as a whole, to a particular group of people, to a research group, or to enterprises or other institutions.

In 2006, Godin and Doré, in a series of interviews with researchers from 17 publicly funded research centres and with current and potential users of research results from 11 social and economic organisations, constructed a typology of 11 dimensions of the impacts of science on society. Identifying the type of impact to be measured is crucial when deciding on the choice of methodology or methodologies for assessing the impact of public research and development. Godin and Doré use the concept of science and technology, which is a broader concept than public R&D.

Eleven dimensions of the impacts of research on society

(Godin and Doré, 2006)

1. **Science impacts:** Research results have an effect on the subsequent progress of knowledge, thanks to advances in theories, methodologies, models, and facts. They affect the formation and development of disciplines and training and can also affect the development of research itself, generating interdisciplinary, cross-cutting, and international research.
2. **Technology impacts:** Product, process, and service innovations, as well as technical know-how, are types of impacts that partly result from research activities. There are few indicators, other than patents, for properly assessing this dimension, at least until work based on innovation surveys results in an analysis of outputs and impacts, as well as innovation activity itself.
3. **Economy impacts:** These refer to the impact on an organisation's budgetary sit-

uation (operating costs, revenues, profits, the sale price of products); on the sources of finance, investments and production activities; and on the development of new markets. At the aggregate level, they can also refer to economic returns, through either economic growth or productivity growth, of a given geographical unit. It is probably the best-known dimension.

4. **Culture impacts:** These relate to what people often call public understanding of science but, above all, to four types of knowledge: know-what, know-why, know-how, and know who. In other words, these are the impacts on an individual's knowledge and understanding of ideas and reality, as well as intellectual and practical skills, attitudes, interests, values, and beliefs.
5. **Society impacts:** Research affects the welfare, behaviour, practices, and activities of people and groups, including their well-being and quality of life. It also concerns customs and habits: consumption, work, sexuality, sports, and food. Research can contribute to changing society's views and modernise ways of doing business.
6. **Policy impacts:** Research influences how policy makers and policies act. It can provide evidence that influences policy decisions and can enhance citizens' participation in scientific and technological decisions.
7. **Organisation impacts:** These refer to the effects on the activities of institutions and organisations: planning, organisation of work, administration, human resources, etc.
8. **Health impacts:** These relate to impacts on public health, e.g. life expectancy, prevention of illnesses, and the health-care system.
9. **Environment impacts:** These concern management of the environment, notably natural resources and environmental pollution, as well as the impacts of research on climate and meteorology.
10. **Symbolic impacts:** These are the gains in areas such as credibility due to undertaking R&D, or linked to universities or research institutions that offer gains in terms of potential clients, etc.
11. **Training impacts:** These are impacts of research on curricula, pedagogical tools, qualifications, entry into the workforce, etc.

All but the first three dimensions are somewhat new to statisticians, as they are less tangible and therefore difficult to measure or evaluate. This typology provides a checklist to remind principal investigators and research support officers that research affects areas other than those usually identified and measured. Further, impact has now the same weighting as science when evaluating applications in many research programmes. This, in turn, will influence funding strategies at universities.

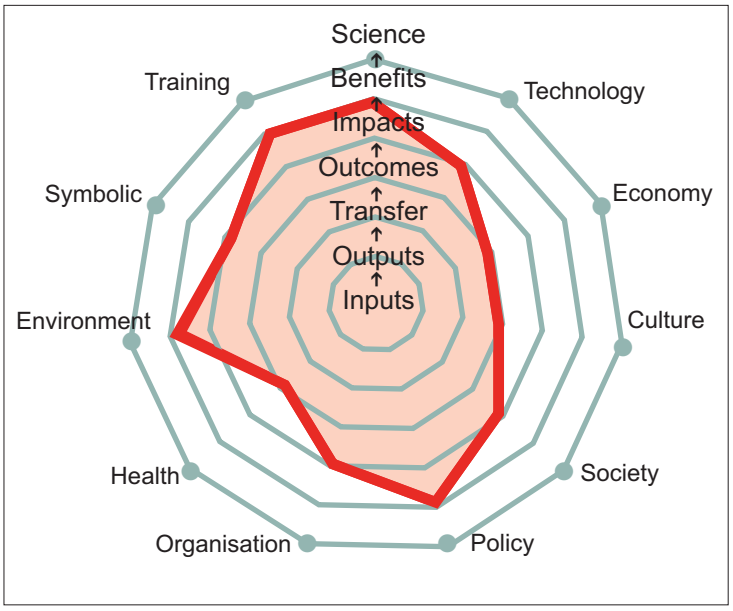

Figure 1: Impact profile

Mind the gap

Relevant prior or ex-ante impact assessment (IA) can play an important, and sometimes crucial, part in a funding application. However, few research outcomes (productivity gains, population health improvements and environmental benefits, for example) only have one cause, and the spillovers are multiple.

There is often a considerable gap between ex-ante impact assessment and ex-post findings. This is mainly due to the evolution of the context of the research and the research capacity, as well as changes in society's needs and expectations. This often leads to a lengthy time lag from idea to product, thus the ex-post IA offers only indirect insights related to actual research priorities.

Research impact should therefore be assessed in any research project proposal. Proposals should describe how the anticipated results will have short and long-term impacts, and how the results are planned to be disseminated and targeted towards the different audiences.

Impact profile

To track the progress of a project, it is important to establish an 'input to benefit' chain model which articulates how, and by what mechanisms, planned activities will affect the intended impacts. A set of SMART impact indicators (Specific, Measurable, Achievable, Realistic, Time-dependent) could be a very relevant and useful tracking tool, as long as one remembers that, to a great extent, you get what you measure!

The elements in the value chain consist of:

- Inputs – financial and human resources, communication, cooperation
- Outputs – discoveries, publications, citations, patents, etc.
- Transfers – engagement with end-users
- Outcomes – new/improved products, services, or processes
- Impacts – achieved improvements
- Benefits – to society

(partly inspired by Michelle Duryea, Mark Hochmann and Andrew Parfitt – see references).

Figure 1 illustrates how research can have a wide impact on society. The eleven impact dimensions shown above, depending on the situation and the discipline, differ in their score on the value chain from 'inputs' to 'benefits'. The red-coloured frame in the radar chart can, in this case, represent a given project's expected or achieved results.

Variations in discipline will, to a certain extent, influence the availability and robustness of the indicators, which should be quantitative, qualitative, and progressive in order to allow for monitoring of progress.

The more research activity related the project objectives are, the closer the outputs will be to the inputs. Moving up the value chain,

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some of the successful outputs will (depending on the objectives, discipline and indicators) evolve into benefits to society. When specific and strategic objectives are accomplished with high impacts within all the eleven dimesions, there are more benefits to society.

In figure 1, the higher the impact value, the closer the red line will be to the circumference of the web. In this example, there is a very high impact score for science, policy, environment, and training. This illustrates that the project has achieved considerable improvements within these four dimensions and is close to achieving the highest score – 'benefits'. On the contrary, you will see that the economy, culture, and health dimensions have the lowest score. They are all in 'transfer', meaning the project has gained an exposure to end users, but has not yet (intentionally or unintentionally) achieved the 'benefits' value within these three dimensions.

The above example could represent a research project focusing on and developing new and improved methods to assess environmental consequences. Here, the estimated results would be of great importance within the ensuing interdisciplinary work in policy development, environmental issues, and training.

To add further value to the impact profile, depending on the use, one could include parameters such as external research funding, international research collaborations, and dissemination activities.

Dissemination

To improve the dialogue, dissemination, and use of scientific results in society as a whole, it will be necessary to make exploitation plans and strategies for enhancing the impact via social networking websites, online communities, and Web 2.0, for example.

International standard

It is important that an internationally acknowledged comparable standard for impact profiles is developed and implemented at both university and research support office level. Besides being used for research policy measures, it ought to be an integrated part of the individual proposal or project. The function of impact profiles and the chosen indicators depends, to a large degree, on the political system and the political culture.

An international standard would pave the way for research administrators and managers, and would better support researchers in identifying the specific benefits of their research and its potential users. This will contribute to accountability, which can be important when ensuring future political support for research in a world where collaboration has become the new competition. RG

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